



# **Armed Forces College of Medicine AFCM**



# Pathology of bone tumors (1)

# INTENDED LEARNING OBJECTIVES (ILO)



**By the end of this lecture the student will be able to:**

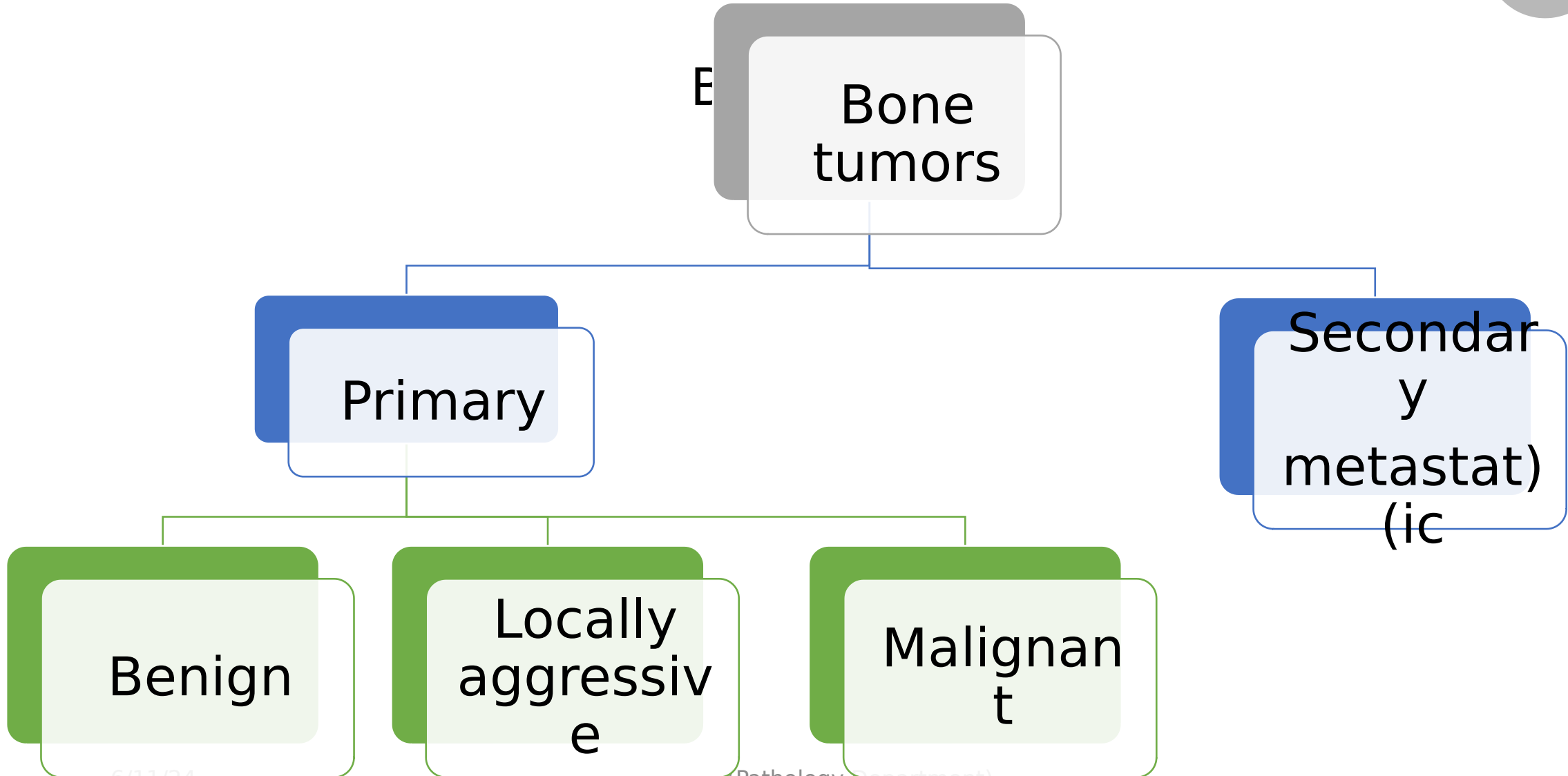
- 1. Classify bone tumors & enumerate them.**
- 2. Enumerate benign bone tumors**
- 3. Discuss pathology of compact osteoma & osteoid osteoma**
- 4. Describe pathology of benign cartilage forming tumors**
- 5. Describe the pathology of giant cell tumor of bone.**
- 6. Mention the radiologic findings of giant cell**

# Lecture Plan



- 1. Part 1 (5 min) Introduction**
- 2. Part 2 (35 min) Main lecture**
- 3. Part 3 (5 min) Summary**
- 4. Lecture Quiz (5 min)**

# Bone Tumors



# TUMORS OF BONE



## BENIGN

**Osteoma &  
osteoblastoma**

**Osteochondroma  
(exostosis)**

**Chondroma**

**Chondroblastoma**

**Chondromyxoid fibroma**

**Fibroma**

**Others: hemangioma**

## LOCALLY MALIGNANT

**Giant cell tumor  
Adamantinoma  
(Ameloblastoma)  
Chordoma**

## MALIGNANT

**OSTEOSARCOMA  
Chondrosarcoma  
Fibrosarcoma  
Ewing's sarcoma  
Plasma cell  
neoplasms**

# Benign bone tumors



## **Osteoma**

- ❖ **Compact osteoma.**
- ❖ **Osteoid osteoma and**
- ❖ **Osteoblastoma**

# Compact Osteoma



**Site:** Flat bones of the skull and face.

**Gross:** A hemispherical, non capsulated, hard, ivory like mass.

**Microscopic:**

*Well-differentiated* mature lamellar bony trabeculae separated by fibrovascular tissue.



<http://www.pathologyoutlines.com/topic/boneosteoma.html>

oundation of Medical Cadet Module



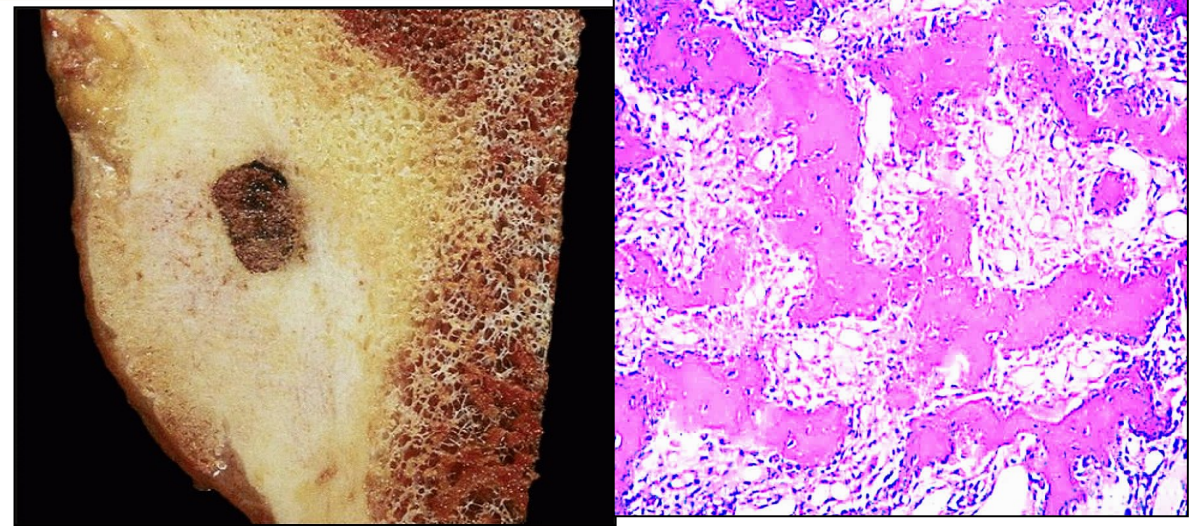
# Osteoid Osteoma



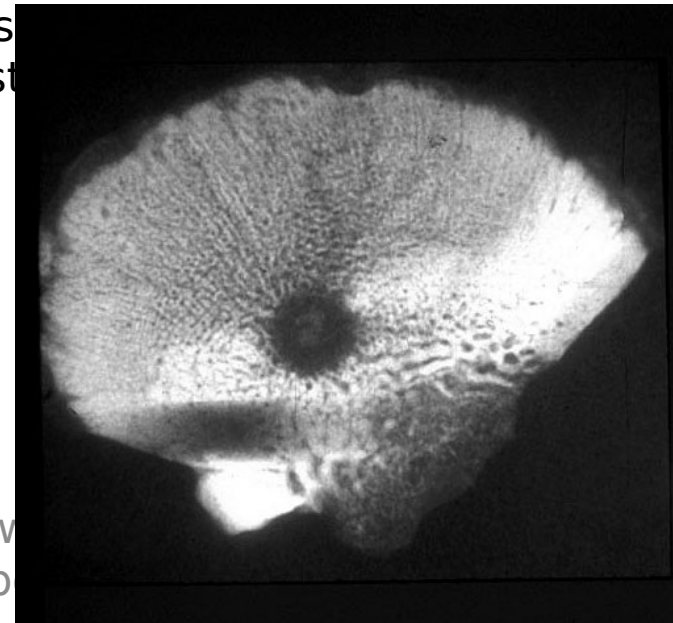
**CIP:**

- ❖ The tumor is associated with nocturnal pain, due to production of prostaglandin E2, by proliferating osteoblasts.
- ❖ The pain is markedly improved by salicylates.

**X-ray: A radiolucent**



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# Osteoid Osteoma



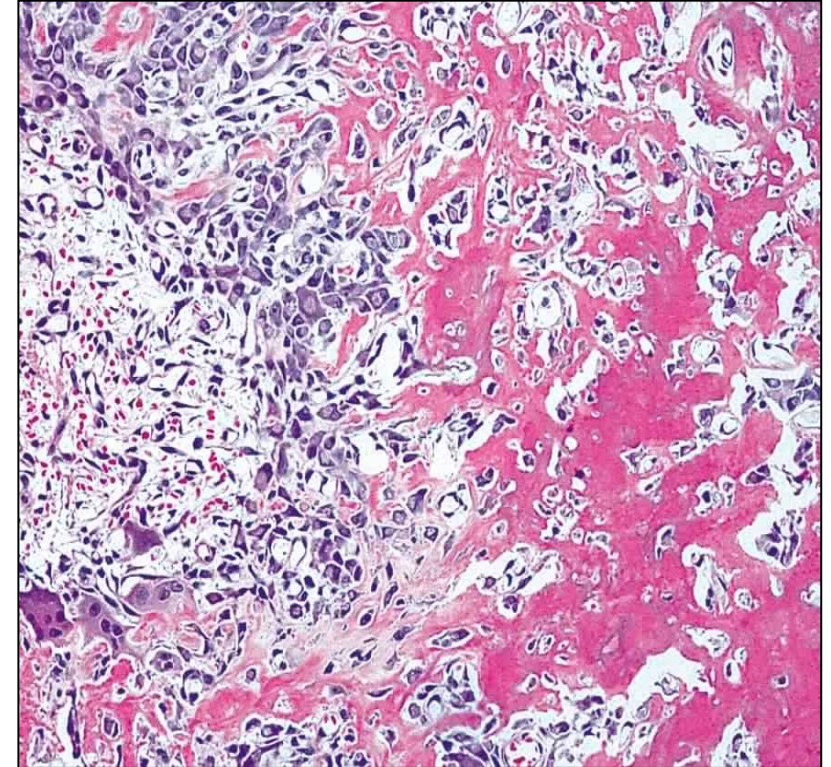
- ❖ **Size:** Small (usually less than 1cm).
- ❖ **Site:** The diaphysis of a long bone, often the tibia or femur.
- ❖ **Gross:** A well defined, gritty & friable.
- ❖ **Mic:** Trabeculae of osteoid woven bone, surrounded by sclerotic bone formation.



# Osteoblastoma



- *It is similar to an osteoid Osteoma but*
  - \* Larger (>2 cm).
  - \* Often involves vertebrae.



<http://www.pathologyoutlines.com/topic/boneosteoblastoma.html>

# **BENIGN CARTILAGE-FORMING TUMOURS (CHONDROBLASTIC)**



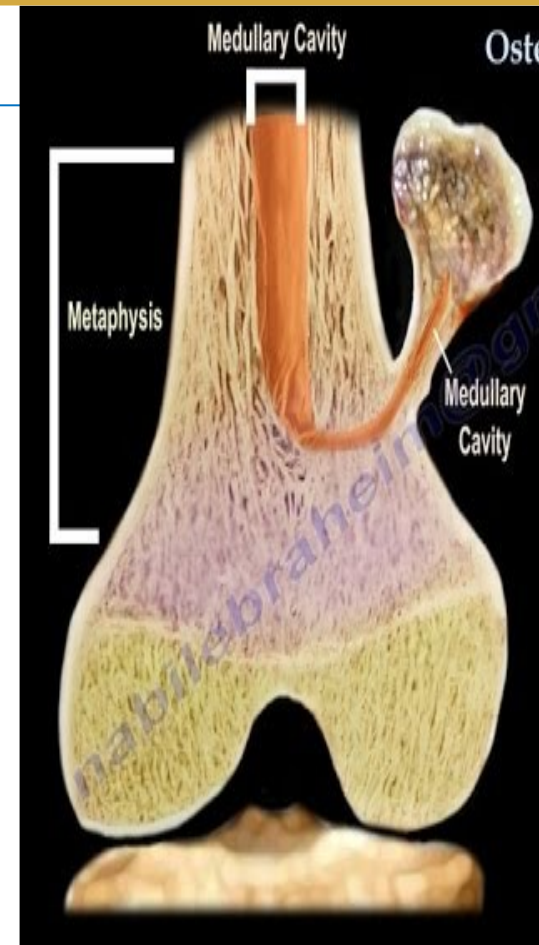
- 1-Osteocartilaginous Exostoses  
(Osteochondromas)
- 2- Enchondroma



# Osteocartilaginous Exostoses (Osteochondromas)



- ❖ It is not a true tumor but regarded as a disorder of growth & development.
- ❖ It originates from aberrant lateral growth of epiphyseal growth plate .
- ❖ **Incidence:**
- ❖ They are the commonest of benign cartilage-forming lesions.



<https://www.youtube.com/watch?v=94hmcpM24aA>



<https://radiopaedia.org/cases/osteochondroma-13>

# Osteocartilaginous Exostoses (Osteochondromas)



- ❖ **No:** *single or multiple* .
- ❖ **Size:** Small (usually < than 1 cm).
- ❖ **Site:**  
Metaphysis of long bones, most commonly lower femur and upper tibia (i.e. around knee) .



# Osteocartilaginous Exostoses (Osteochondromas)



- ❖ **Gross:**  
Mushroom-shaped, cartilage-capped lesions.
- ❖ **Mic:**
- ❖ \*Outer cap composed of mature cartilage
- ❖ \*Inner mature lamellar bone and bone marrow.
- ❖ **Clinical picture:** Asymptomatic, pain, deformity, or undergo malignant transformation (rare)



<https://emedicine.medscape.com/article/1256477-workup>



# Enchondroma



- ❖ **Enchondroma:** It is a benign cartilage-forming tumour that develops within the medullary cavity of bone.
- ❖ **Site:** Mostly the short tubular bones of the hands and feet.
- ❖ **Clinical picture:** Usually asymptomatic.
- ❖ **Complication:** Malignant transformation into chondrosarcoma, which is



<http://www.texasfootdoctor.org/enchondron>



# Enchondroma



## **No:**

Single or multiple  
(***enchondromatosis***).

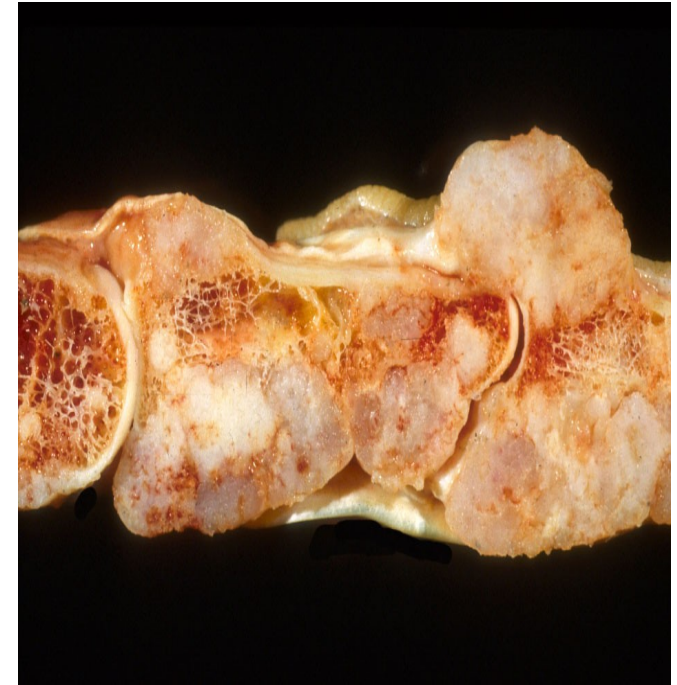
- **Maffucci's syndrome**: Multiple enchondromas with multiple soft tissue haemangiomas.

## **Gross:**

A lobulated, bluish-grey, translucent, cartilaginous mass.

## **Mic:**

Normal adult hyaline cartilage separated by fibro-vascular stroma.



<http://www.pathologyoutlines.com/topic/boneenchondromaenchondromaslongbones.html>

# TUMORS OF BONE



## BENIGN

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**Chondroblastoma**  
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## LOCALLY MALIGNANT

- 1-Giant cell tumor**
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- 3- Chordoma**

## MALIGNANT

**OSTEOSARCOMA**  
**Chondrosarcoma**  
**Fibrosarcoma**  
**Ewing's sarcoma**  
**Plasma cell neoplasms**

# Giant cell tumor (osteoclastoma)

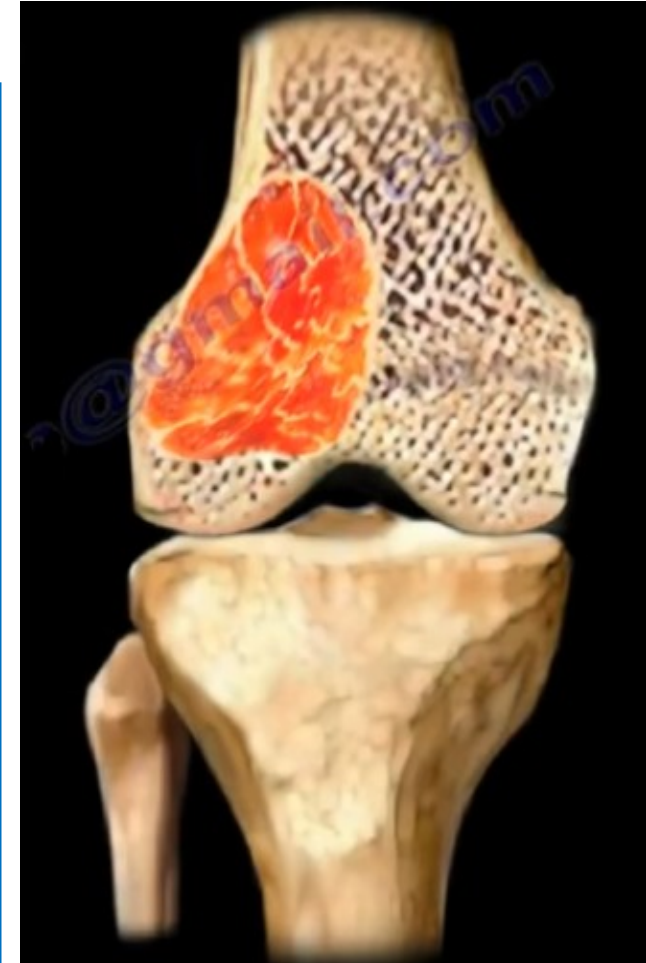


## ❖ Age:

- Usually after the age of 20 years but may occur in younger ages.
- Most giant cell tumors are locally malignant.
- Few cases (10-20%) are malignant and metastasize.

## ❖ Site:

- Around the knee joint (distal femur , proximal tibia)
- Both epiphysis and metaphysis



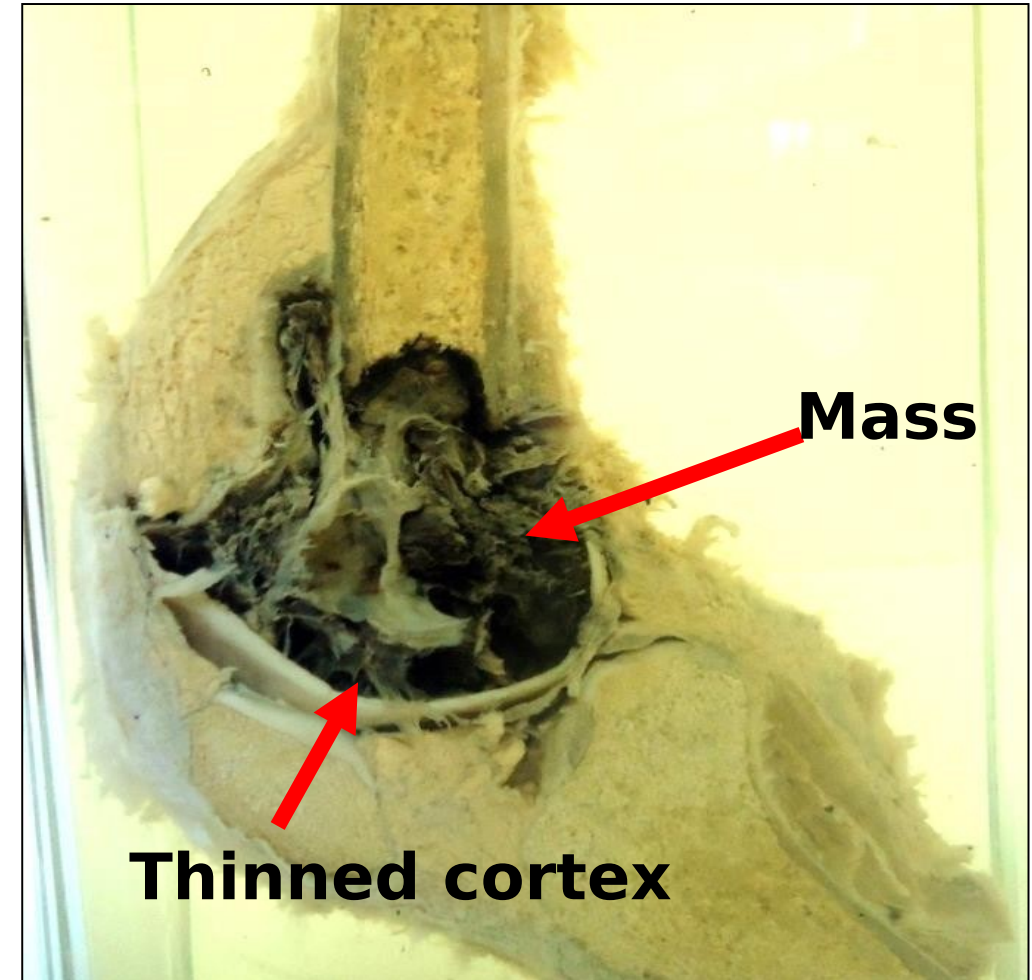
<https://www.youtube.com/watch?v=hY08PVkqPr>

# Giant cell tumor (osteoclastoma)



## Gross:

- ❖ An **eccentric mass** that **erodes subchondral bone**
- ❖ The tumor tissue is **grayish brown** with **cystic degeneration** filled with hemorrhage.
- ❖ The covering cortical bone becomes markedly **thinned** (**egg shell-like**).





# Giant cell tumor (osteoclastoma)

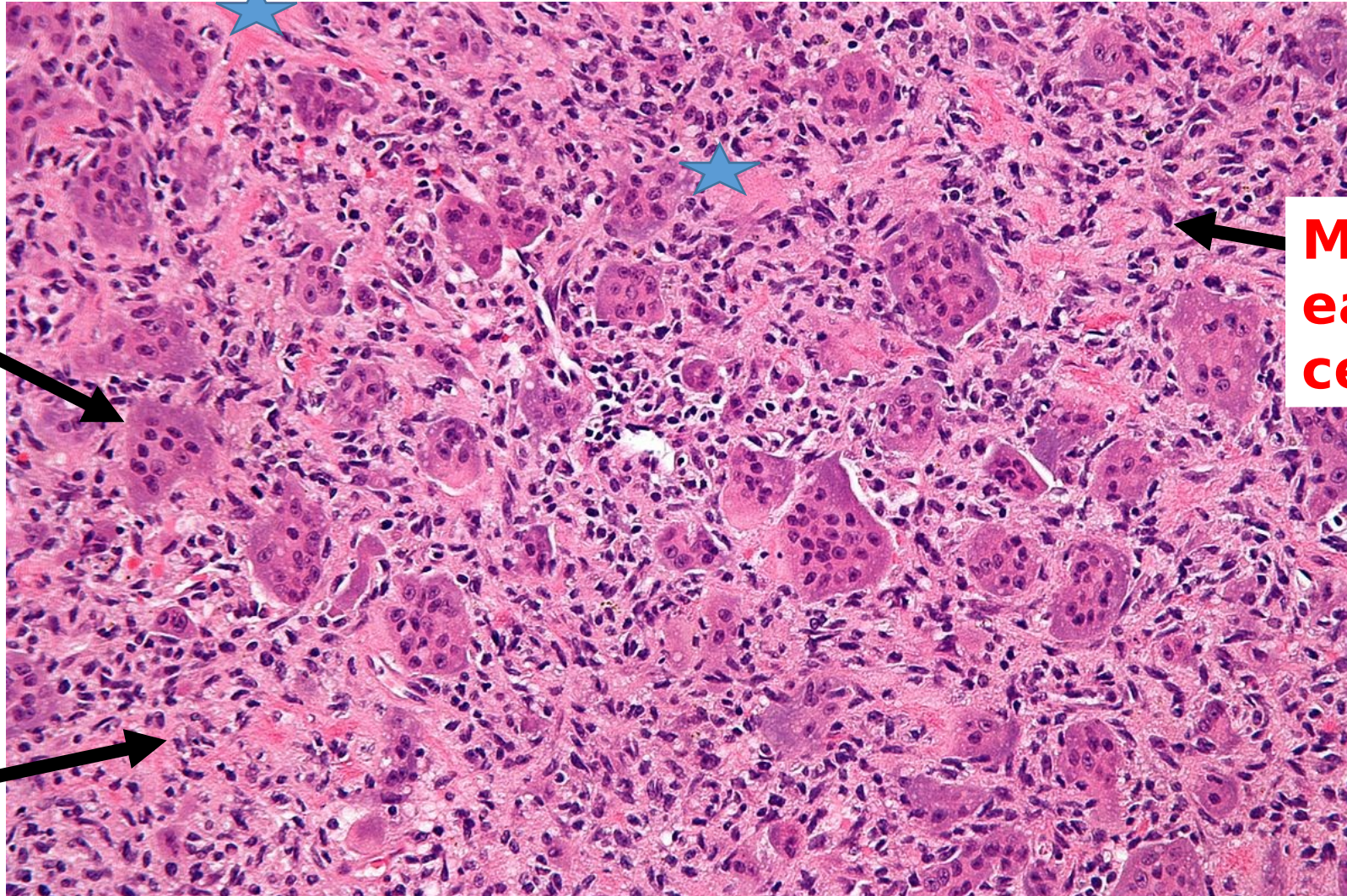


## Microscopic:

**Multinucleated giant cells**

**Mononuclear tumor cells**

**Collagenous stroma, vessels and areas of hemorrhage.**





# Giant Cell Tumor Of Bone (OSTEOCLASTOMA)



## Microscopic:

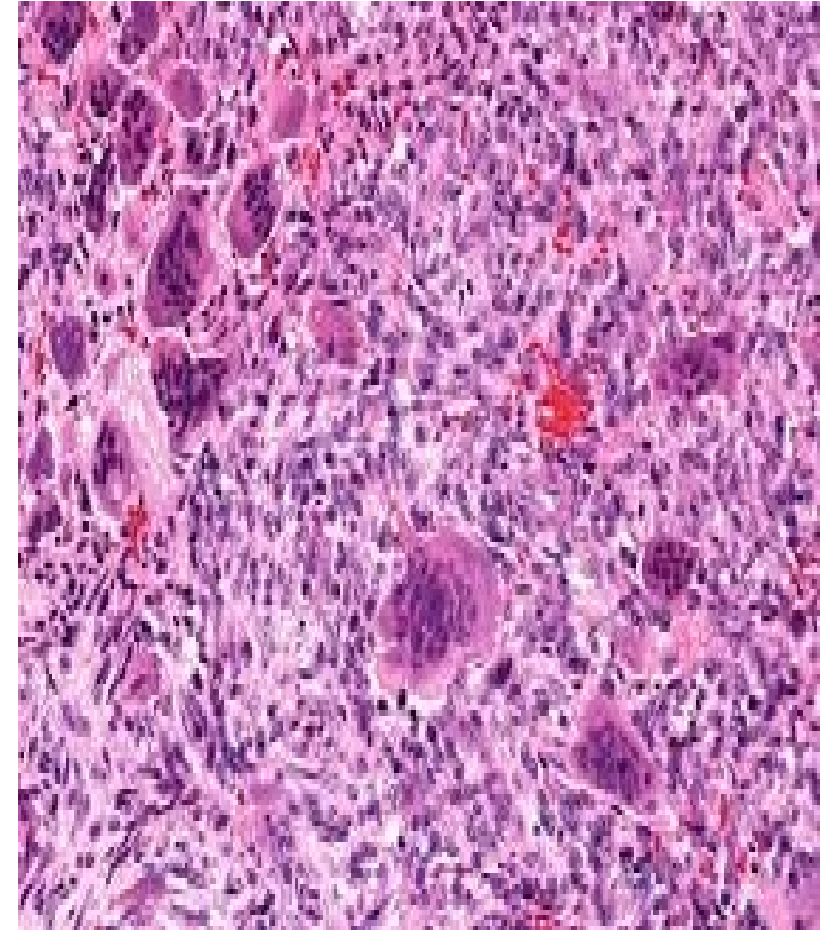
### **1. Neoplastic cells:**

**Oval mononuclear stromal cells, dark nuclei with variable atypia.**

### **2. Non neoplastic cells:**

**Multinucleated giant cells; osteoclastic type, containing up to 100 nuclei.**

### **3. Stroma: Collagenous, proliferated vessels with areas of hemorrhage.**



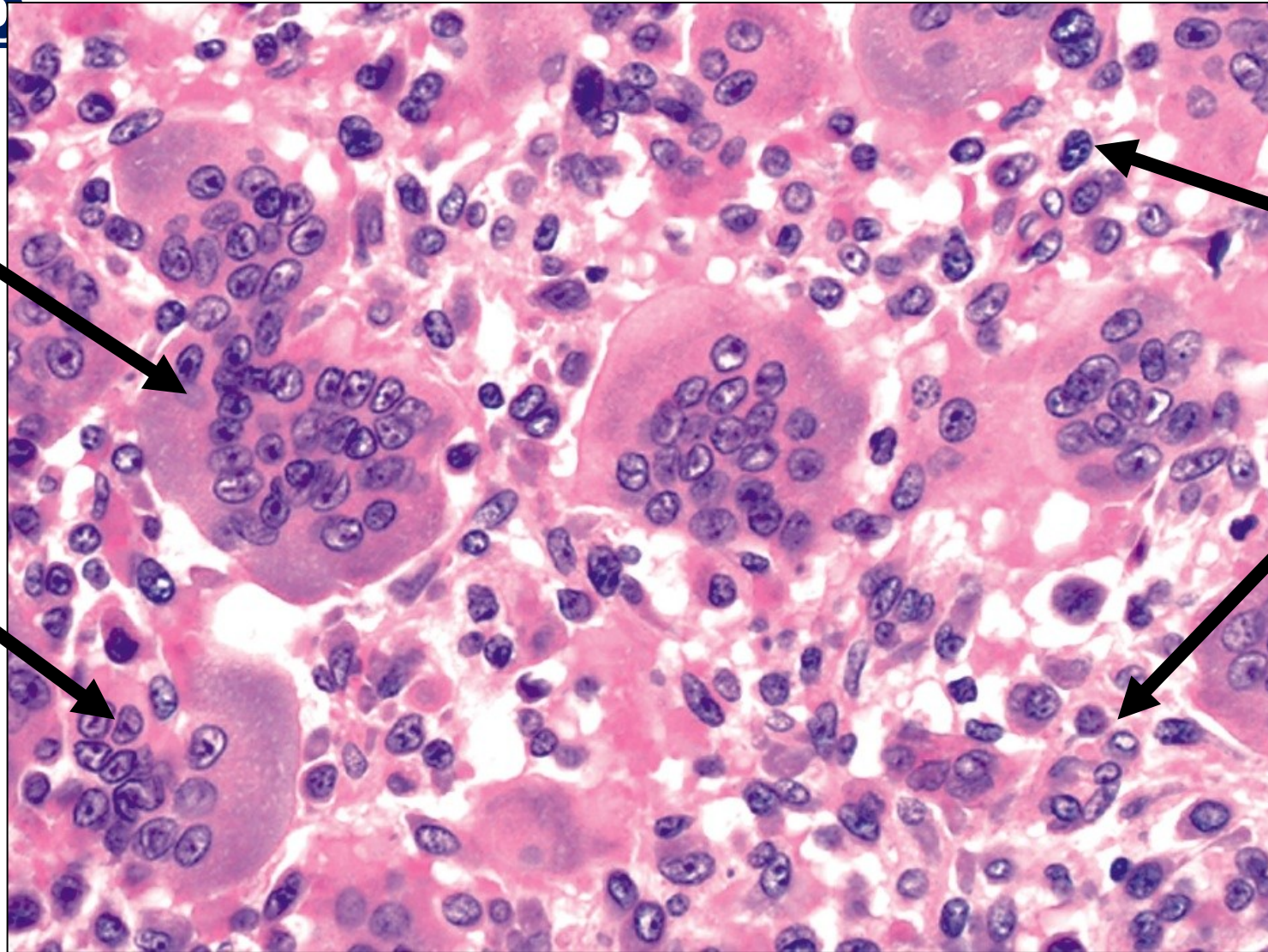
<http://ilovepathology.com/giant-cell-tumor-bone/>

# Giant cell tumor (osteoclastoma)



## Microscopic:

**Multinucleated giant cells**  
(up to 100 nuclei)  
(osteoclastic type) **NON-NEOPLASTIC** (fusion of monocytes-macrophages)

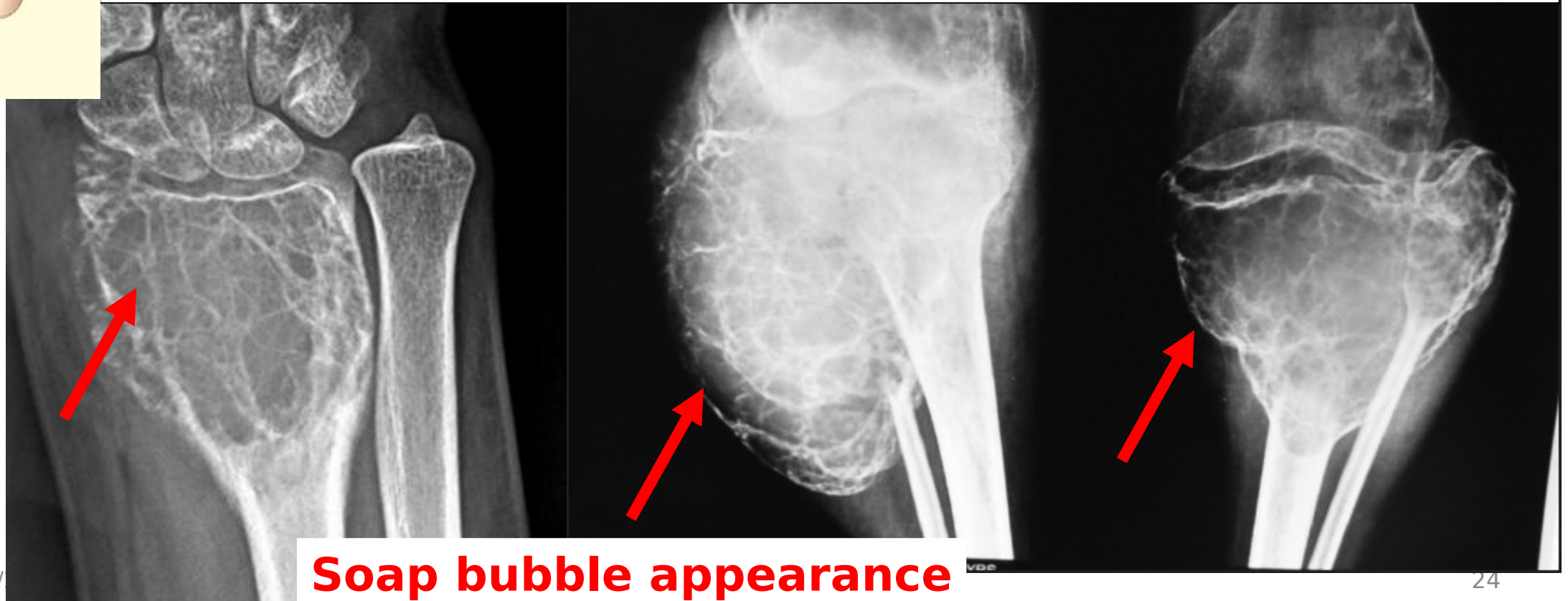


**Neoplastic**  
**Stromal mononuclear TUMOR CELLS**  
Oval, mononuclear, dark nuclei with atypia

# Giant cell tumor (osteoclastoma)



Eccentric osteolytic lesion with an adjacent thinned cortex and with no periosteal reaction (soap bubble like).



**Soap bubble appearance**



# Giant cell tumor (osteoclastoma)



## Spread:

- ❖ 80-90% of cases spread **locally**.
- ❖ The remaining cases may have a malignant behaviour and metastasize by blood.

# TUMORS OF BONE



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**3-Fibrosarcoma**  
**4-Ewing's sarcoma**  
**5-Plasma cell neoplasms**

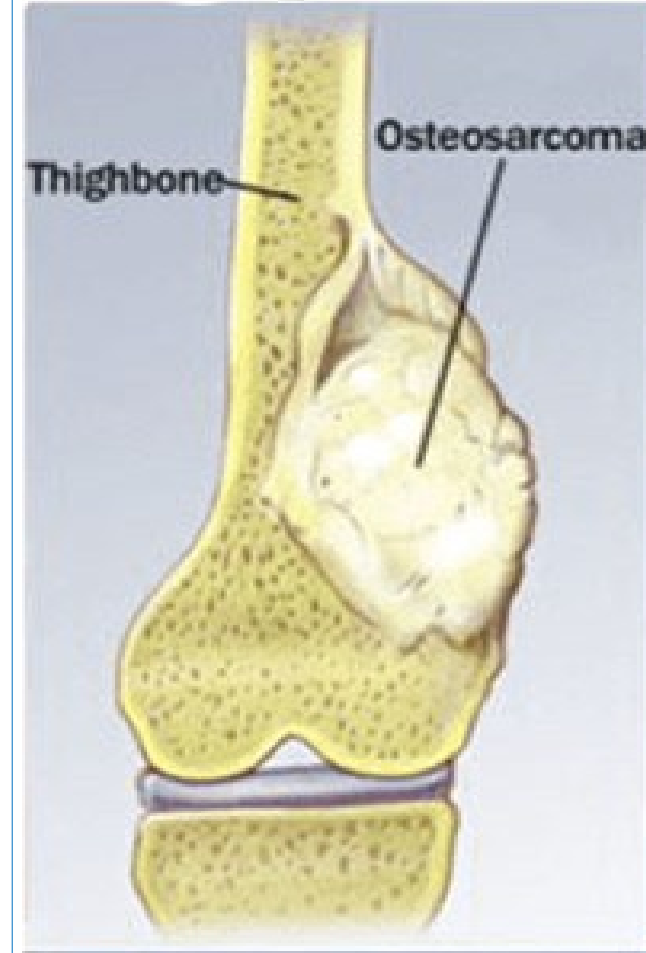
# OSTEOSARCOMA (Osteogenic sarcoma) -1



- It is the **most common primary malignant tumor** of bone.
- The neoplastic cells are **osteogenic** □ secrete bone matrix (osteoid and/or osseous tissue).

## **Predisposing Factors:**

1. Trauma.
2. Irradiation.
3. Paget's disease of bone.
4. Fibrous dysplasia.



**Osteosarcoma**

# OSTEOSARCOMA (Osteogenic sarcoma) -1

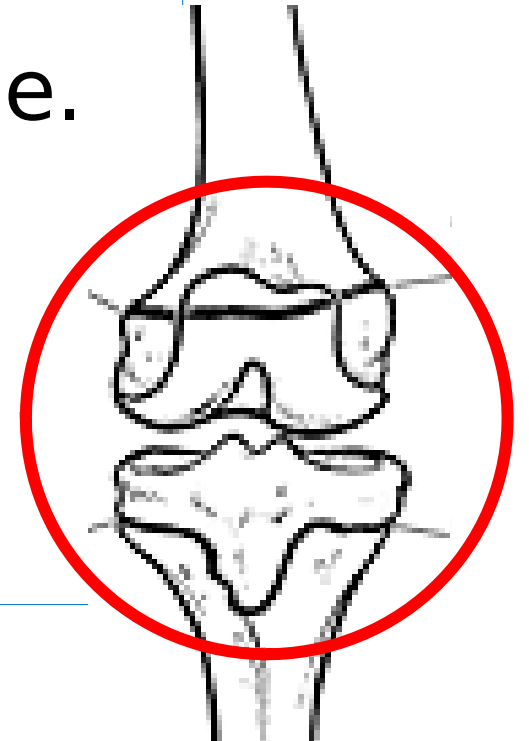


## ❖ Age:

- Children and young adults, usually **below 20 years.**
- In the elderly on top of Paget's disease.

## ❖ Sites:

- Distal femur and proximal tibia
- Starts within the **metaphysis**



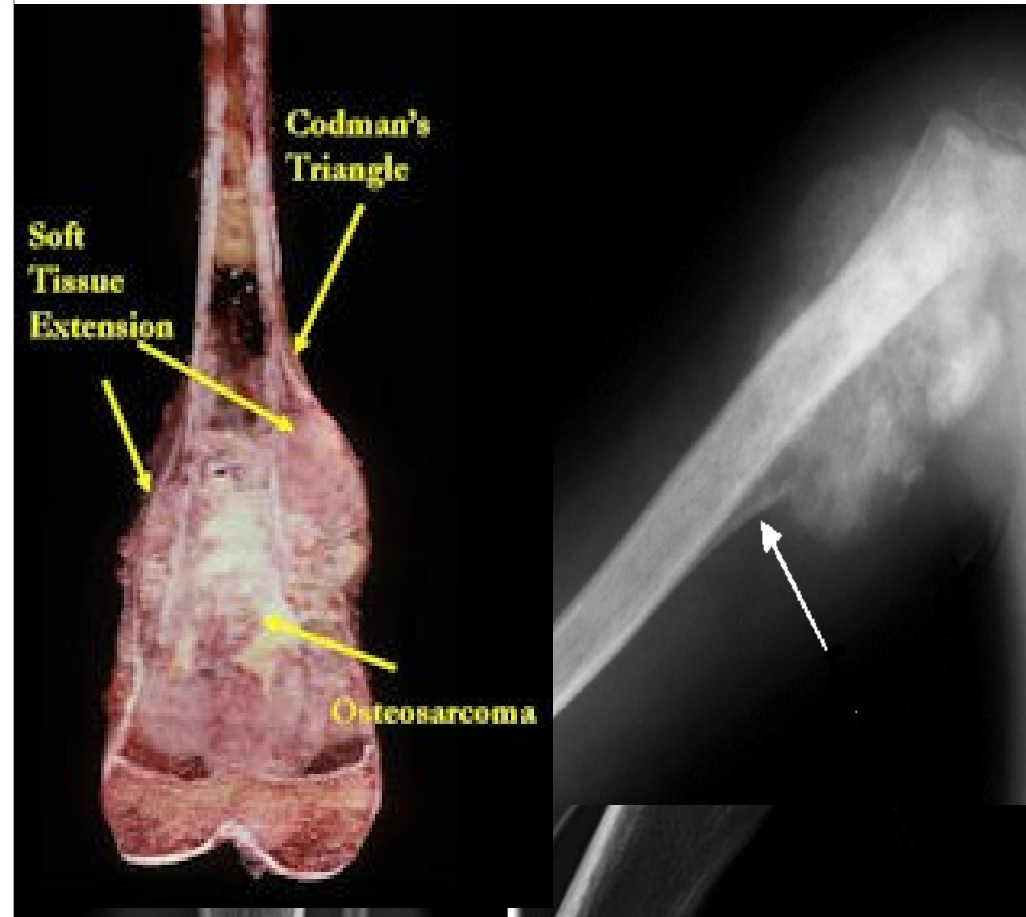
# OSTEOSARCOMA (Osteogenic sarcoma) -1



## Radiological Features:

1. Tumors rich in bone matrix may exhibit Sun ray appearance in X ray films.

2. Periosteal elevation may be associated with reactive periosteal bone formation in the triangle between the cortex and elevated periosteum. This can be

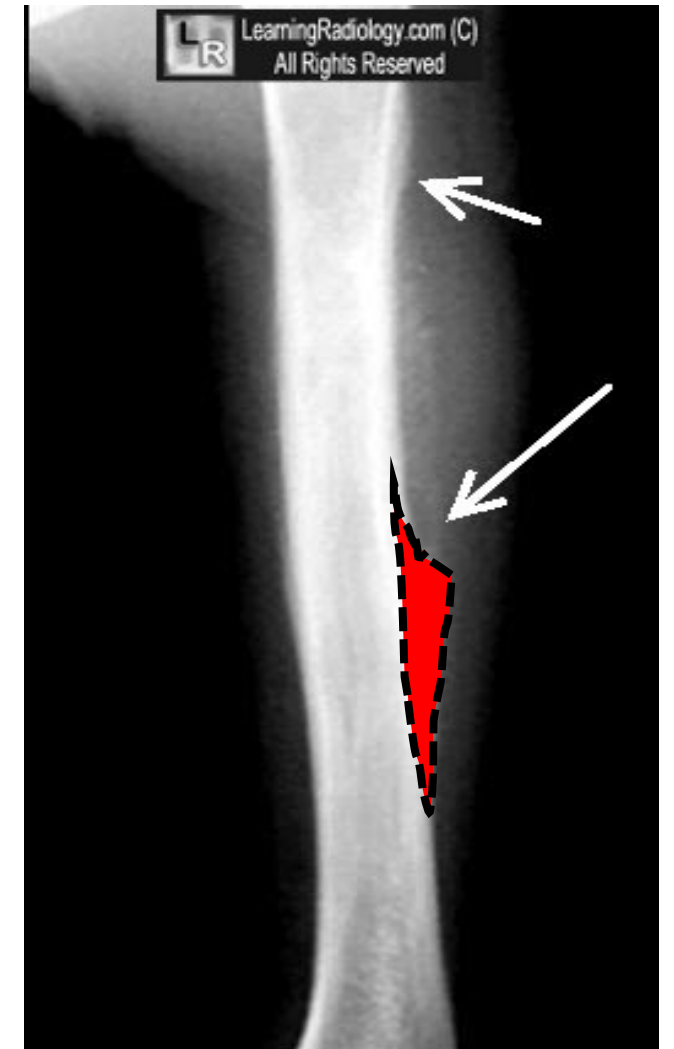
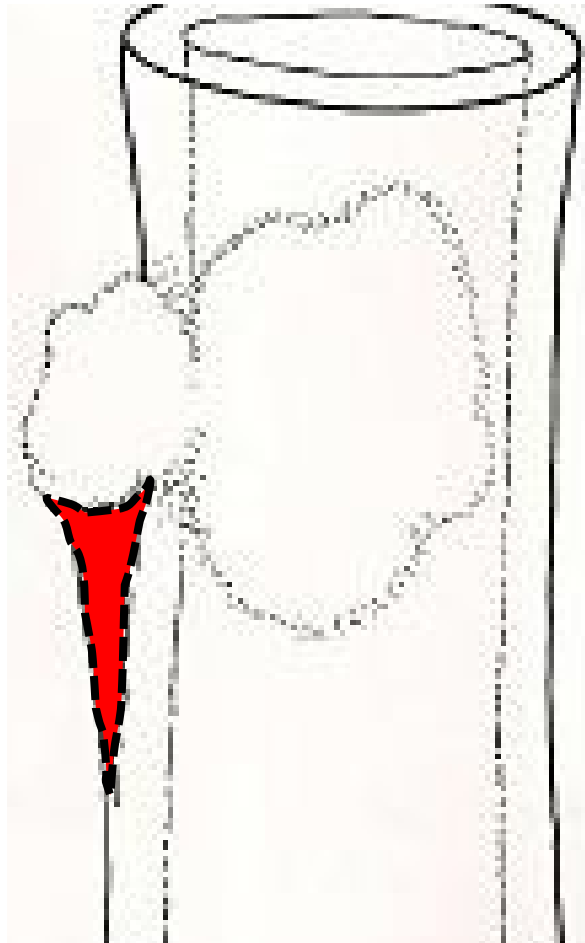


# OSTEOSARCOMA (Osteogenic sarcoma) -1



**Sun-ray**

# OSTEOSARCOMA (Osteogenic sarcoma) -1



**Codman's**

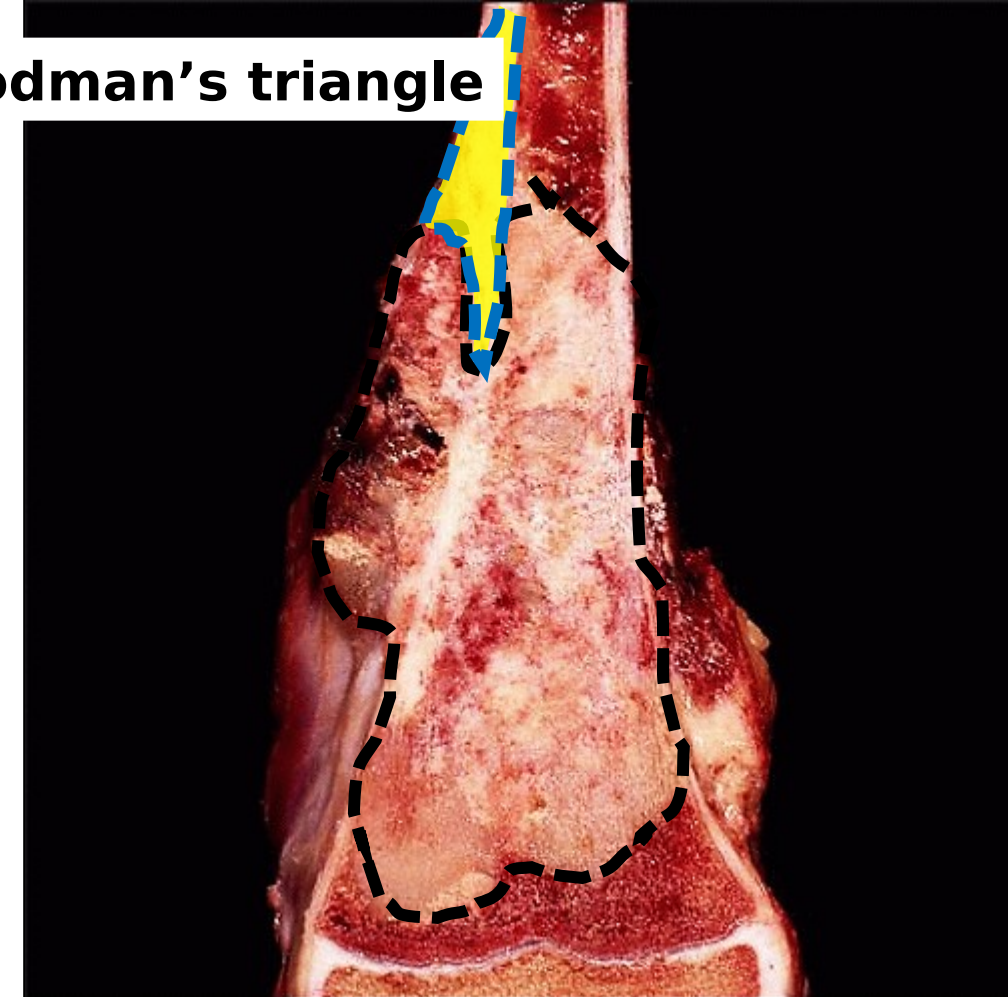
# OSTEOSARCOMA (Osteogenic sarcoma) -1



## Gross:

- ❖ Large mass within the **medullary canal** and destroys the bone cortex.
- ❖ The **periosteum** is elevated □ penetrated □ extension adjacent soft tissue.
- ❖ Hemorrhage and necrosis are usually extensive.
- ❖ Osteo**sclerotic** or Osteo**lytic** according to the degree of

Codman's triangle





# OSTEOSARCOMA (Osteogenic sarcoma) -1



## Microscopic:

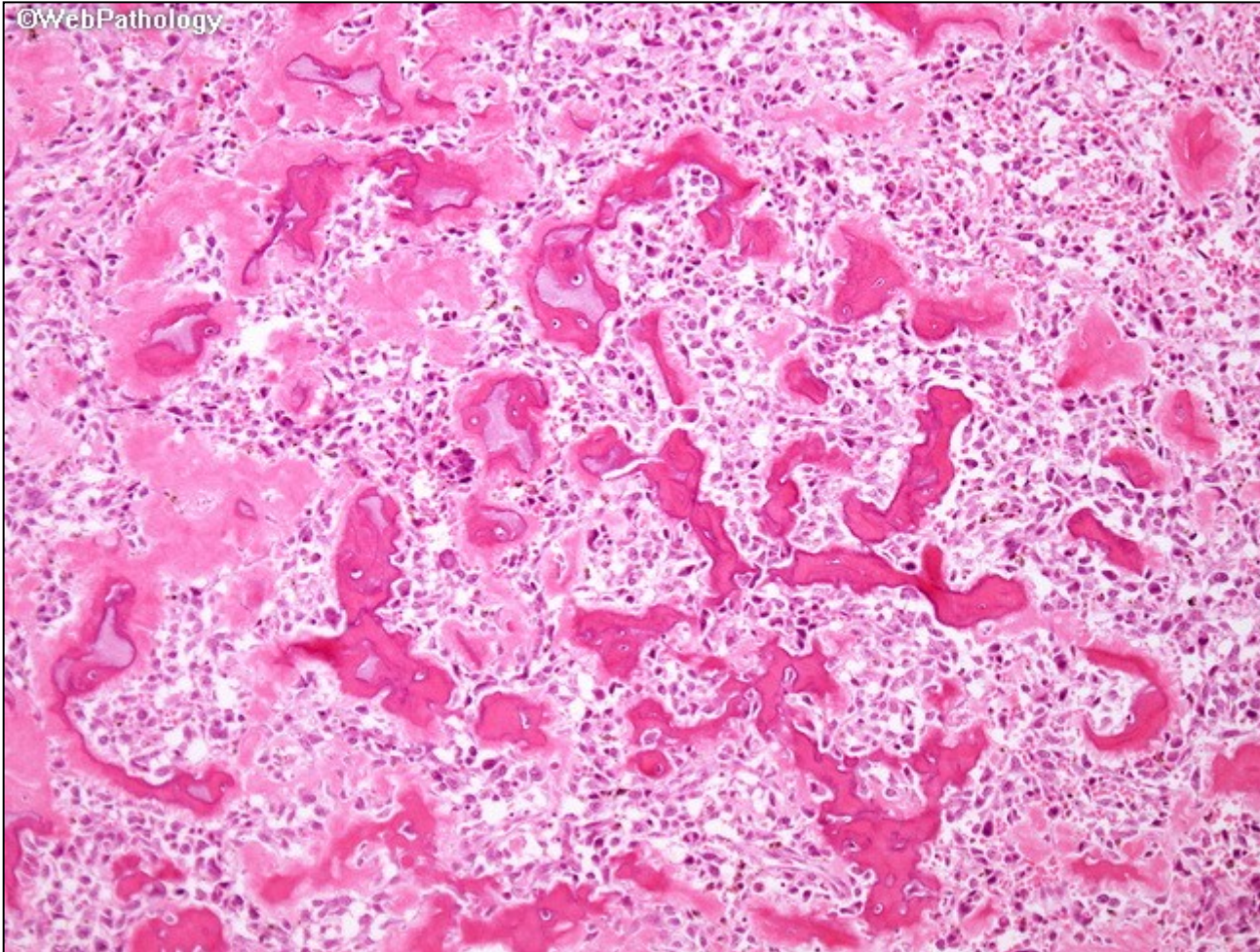
- 1. Tumor cells:** Pleomorphic (spindle cells) with large dark nuclei and abnormal mitotic activity.
- 2. Matrix :** Osteoid tissue (prominent in better differentiated tumors, minimal in poorly differentiated tumors).
- 3. Thin-walled vessels** are present
- 4.** Areas of necrosis and hemorrhage are frequent.



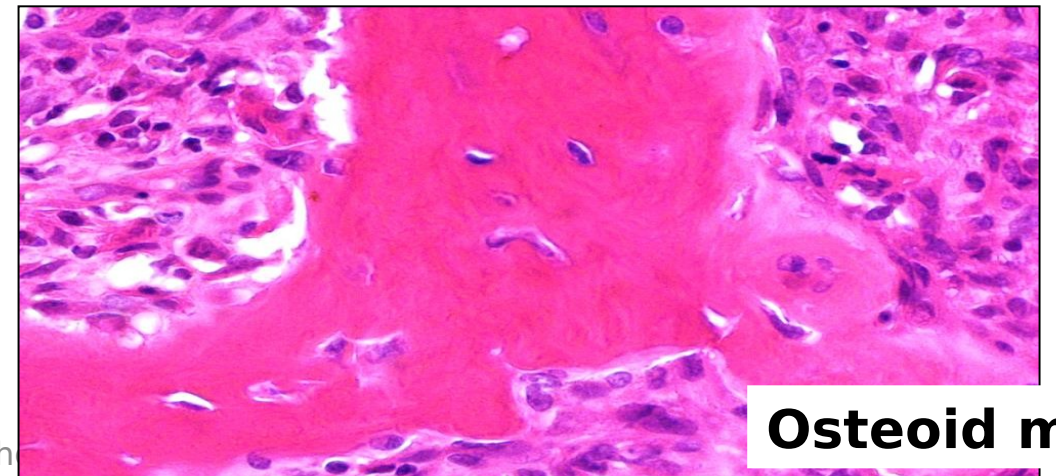
# OSTEOSARCOMA (Osteogenic sarcoma) -1



©WebPathology



**Malignant cells**



**Osteoid matrix**



# OSTEOSARCOMA (Osteogenic sarcoma) -1



## ❖ Spread:

- Direct → surrounding soft tissue
- Blood spread → lung and other sites

## ❖ Prognosis:

Highly malignant tumor → rapid spread and poor prognosis



## Lecture Quiz



A 15 years old male, presented with pain and swelling around his left knee joint that started few weeks ago. X- ray was done and revealed an osteolytic metaphyseal mass lesion with adjacent periosteal elevation and subperiosteal triangular reaction. **A biopsy from this lesion will reveal:**

- A. Islands of epithelium in a fibrous stroma.
- B. Multinucleated giant cells, round cells and fibrous stroma
- C. Increased number of lymphocytes and plasma cells
- D. Pleomorphic spindle cells and osteoid matrix
- E. Large amount of osteoid matrix and benign fibroblasts

# Lecture Quiz



**A growth arises in the upper tibia, grossly appearing as a mushroom shaped mass:**

- a. This is a benign tumor.
- b. It arises also in skull bones.
- c. It originates from medullary canal.
- d. Is called exotosis.
- e. Spreads by blood

## SUGGESTED TEXTBOOKS



1. Robbins basic pathology, ninth Edition
2. Kaplan step 1 pathology lecture notes 2017 (P.78-98)